Did you know…

- When Johnson Space Center's (JSC's) Weightless Environment Training Facility proved inadequate for Extravehicular Activity (EVA) training in anticipation of International Space Station (ISS) construction, plans were put into motion for the Neutral Buoyancy Laboratory (NBL).
- JSC named the NBL training facility in honor of the late astronaut M.L. "Sonny" Carter, who was instrumental in developing many of the current space-walking techniques used by astronauts.
- The Sonny Carter Training facility was retrofitted to house the new NBL, which began operations in January 1997.
- The NBL was sized to perform two activities simultaneously; each uses mockups sufficiently large to produce meaningful training content and duration. It holds 6.2-million-gallons, is 102 ft x 202 ft and is 40 ft in depth (20 ft above ground level and 20 ft below). Even at this size, the ISS, at 350 ft x 240 ft when complete, will not fit inside the NBL.
- The Sonny Carter Training facility provides controlled neutral buoyancy operations to simulate the zero-g, or weightless, condition that is experienced by spacecraft and crew during space flight. It is an essential tool for the design, testing, and development of the ISS and future NASA programs. For the astronaut, the facility provides important pre-flight training for EVA and with the dynamics of body motion under weightless conditions
- The NBL simulation control areas provide resources for all disciplines involved in the execution of EVA training sessions and facility operations, safety, communications, video support, medicine, suit technicians, support divers, crew training, and technical observers.
- A fully-staffed and equipped medical team is on site to provide emergency medical treatment, and to monitor the health of astronauts and divers participating in NBL operations. A hyperbaric chamber is available for immediate treatment of diving-related decompression illness.

☑ YOUR PREPAREDNESS FOR AN AUDIT OF NASA STANDARD FOR UNDERWATER FACILITY AND NON-OPEN WATER OPERATIONS SAFETY WITH THESE SAMPLE AUDIT GUIDE QUESTIONS.

MANAGEMENT:

- Has the Center established an effective system safety program for all neutral buoyancy facility development and modification projects, associated human underwater activities and equipment, and research operations?

QUALITY ASSURANCE:

- Does the quality assurance representative develop and maintain the facility project quality assurance plan and Center procedures and checklists necessary to implement its provisions?

PERSONNEL QUALIFICATIONS:

- Have training, qualification, and certification requirements for test team members been established?

PROCEDURES:

- Have testing and training organizations developed and documented all necessary procedures for safe neutral buoyancy testing and training activities?

FACILITY CERTIFICATION:

- Have neutral buoyancy facilities, including the hyperbaric chamber, been certified for underwater activities by an Operational Readiness Inspection?

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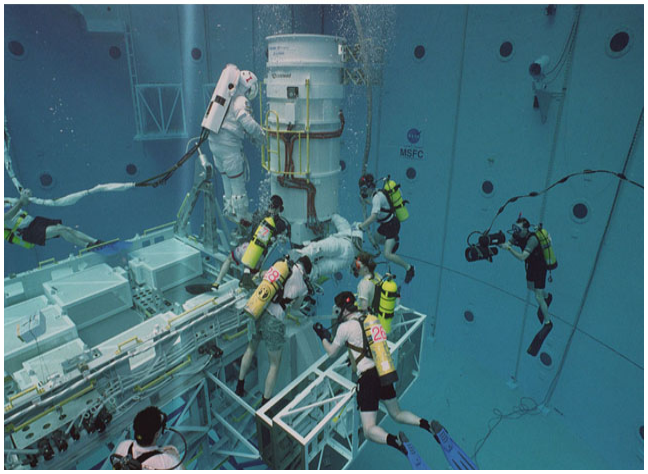
NASA
SAFETY AND MISSION ASSURANCE
REQUIREMENTS

NSS/WS-1740.10

Underwater Facility and Non-Open Water Operations Safety Requirements

Compliance Verification Guide



OFFICE OF SAFETY AND MISSION ASSURANCE

This brochure is intended to be used as a guide only, not as a replacement for the actual policy. To review the NASA Safety Standard for Underwater Facility and Non-Open Water Operations NSS/WS-1740.10 in its entirety, see http://www.hq.nasa.gov/office/codeq/doctree/texttree.htm

MINIMUM AUDIT POINTS FOR NSS/WS-1740-10

Leadership and Management

- **NASA Neutral Buoyancy Facilities**
  - Shall designate system safety program and quality assurance responsibilities to Office of Safety and Mission Assurance (OSMA) organization office that is independent from the underwater neutral buoyancy facility.
    - Objective Quality Evidence (OQE) - Official NASA Center document of Assigned Responsibilities
  - System quality assurance responsibilities shall be designated and assigned to a S&MA organization office that is independent from the underwater neutral buoyancy facility (user) management.
    - OQE – Test Readiness Review Board Roster
  - Shall establish a Test Readiness Review Board before each new test or new series of tests, including facility training activities.
    - OQE – Test Readiness Review Board Roster

Core Process

- **NASA OSMA**
  - Shall perform and document systems safety analyses for all facilities, human testing equipment, and procedures.
    - OQE – System Safety Analysis
  - Shall develop quality and inspection procedures and guidelines that are understood by all test team personnel before any human underwater or training activities.
    - OQE – Approved Quality and Inspection Procedures and Guidelines
- **NASA Neutral Buoyancy Facilities**
  - Shall ensure a hyperbaric chamber is available within 5 minutes for suited underwater activity exposures of a combined water depth and depth-equivalent from suit pressure that equals 20 feet or greater.
    - OQE – Availability of Certified Hyperbaric Chamber
  - Shall develop general, specific, and emergency operating procedures encompassing all diving modes of operation.
    - OQE – Approved Procedures
  - Shall administer training in the form of classroom instruction, hands on training, or on-the-job training, and by periodic drills to maintain proficiency in emergency and off-nominal procedures.
    - OQE – Documented Training
  - Shall establish, make available, and practice (at least annually) emergency medical procedures to ensure that all divers and others subjected to hyperbaric exposure can be assisted, transported, and treated for air embolism and other barroom accidents.
    - OQE – Documented Training Exercise
- **Physicians**
  - Shall certify, at least annually, that all potential underwater personnel are able to perform under hyperbaric pressure.
    - OQE – Medical Records
- **NASA Divers and Suited Test Subjects**
  - Shall be certified by a nationally recognized scuba diver program.
    - OQE – SCUBA Diver Certification

Process Check

- **NASA Neutral Buoyancy Facilities**
  - Shall keep a record of all current maintenance actions accomplished on the facility diving equipment and support apparatus.
    - OQE – Equipment Maintenance Records
  - Shall maintain records that pertain to non-open water operations for five years.
    - OQE – Records of Completed Non-open Water Operations
- **Evaluation Team**
  - Shall conduct formal safety evaluations at least annually to evaluate all neutral buoyancy facility programs for compliance with requirements (in addition to normal management surveillance).
    - OQE – Evaluation and Surveillance Reports
- **Test Readiness Review Board**
  - Shall review and approve the test plan and identify any specific constraints on the use of procedures by the test team.
    - OQE – Concurrence/Approval Review of Test Procedures